SPEECH

Information and Communication Technology – Challenges and Opportunities (Address by Etain Doyle to the Institution of Engineers of Ireland – Conference 2001)

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1.   Introduction

You don't leap a chasm in two bounds – Chinese proverb

I thank the Institution of Engineers of Ireland for inviting me to speak to you today, and to contribute to the debate by addressing the challenges and opportunities presented by information and communication technology. This is a very wide theme, and I intend to concentrate on the communications aspects. An Ireland with 6 million people presents very exciting challenges, and we need as a nation to work out how to meet them in a way that benefits all.

The revolution in the variety and capacity of communications brought to us by new technologies is something that some of you will be dealing with in your work on an everyday basis. I do not presume to discuss it with you in those terms, but rather intend to review broad trends and their relevance to Ireland, in particular from a regulatory point of view.

I shall begin with some observations on the sector: where it is now, where it is heading, and what this means for Ireland, particularly in terms of our infrastructure requirements going forward. I shall then build on this to consider how my Office, which is responsible for regulation, and policy makers, planners and agencies such as the Department of Public Enterprise, IDA and Enterprise Ireland, can contribute to meeting Ireland's needs. This will be by providing the regulatory frameworks for encouraging the industry to eliminate bottlenecks and by paving the way for what is in store for us.

2.   The current situation

Ireland has a substantial track record going back several decades, in developing a world class IT sector, identifying the trends and attracting the key players to invest in Ireland, and building substantial depth in relevant expertise. This sector has played a vital role in Ireland's economic success in recent years. According to IBEC, it directly employs around 100,000 people and contributes around 25 percent of Irish exports[1]. Included in this is our software industry, which is made up of more than 500 companies, and telecommunications companies alone *directly* contribute about 3% to Ireland's GDP. Some of the related developments, such as the emergence of call centres, focussed attention on telecommunications and the need to ensure that this sector also moved forward rapidly. In developing telecommunications, Ireland has drawn on the entrepreneurial and pioneering culture developed in the high technology sector that is well suited to identifying and exploiting opportunities.

Until recently, despite significant investment, telecommunications was very much part of the traditional economy. It was only in mid 1998 that Ireland decided to drop its derogation from full liberalisation of the telecoms market. Although the market has been open for less than three years, one fifth of total turnover is now in the hands of new entrants and prices have fallen substantially.

When the ODTR started in mid-1997, there was just one fixed network provider and the second mobile operator had just started business. There are now three mobile operators and we have 41 fixed operators active in the market, of which about ten have built significant infrastructure, in addition to the infrastructure provided by eircom. So far, other than major backbone routes, new fibre networks in use are mainly in and around Dublin. Some fixed wireless access and satellite installations are somewhat more widespread. The mobile

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[1] IBEC, ICT Ireland Report

operators have their networks, and as GPRS and 3G are rolled out we can look forward to these being developed, adding to the available broadband capacity in many parts of the country.

Regional infrastructure is supported under the National Development Plan, which allocated nearly £120 million to promote investment in advanced telecommunications infrastructure. Unfortunately, partly as a result of the recent global cutbacks in telecommunications investment, several of the projects that would have brought new infrastructure to the regions have been delayed or cancelled.

What is happening in Ireland - and indeed in other countries - is not just the liberalisation of the market, but also a sharp move from a traditionally largely narrowband network to a demand for widespread broadband. The two issues are inextricably tied together, presenting major challenges to the regulator, to operators and the Government. For example, carrier pre-selection (CPS) gives nation-wide access to alternative operators and is the most widespread basis of competitive offerings in Ireland at present, transferring business on the existing network. The ODTR also gives great attention to the development of competition in existing broadband markets such as leased lines and the development of newer broadband solutions such as unbundling the local loop, fixed wireless access, or satellite for example. No country has yet developed its broadband networks so extensively that we can look to them for solutions to the issues we face. The ODTR approach is to provide as many alternatives as possible so operators have as wide a choice as possible in terms of developing broadband access.

I am sometimes asked at what point would infrastructure development be completed? This is like asking at what point would history end. The networks need further upgrading and

expansion to meet current needs, and going forward they will need even more as new business and personal communication applications emerge. This may seem unrealistic in the current gloomy atmosphere, but there are solid reasons why it is so.

While the sector is currently facing some difficulties internationally, these are mainly the results of a painful adjustment following the unreasonable levels of hype of recent years. The fundamental changes in business processes, that can be achieved by increasingly powerful and flexible uses of information and communication technology (ICT), are likely to be accelerated in difficult trading conditions, as the most effective companies in all sectors seek competitive advantage in markets that may have become static or are growing more slowly. This is a development that will affect many other companies. For example, the airline web-sites means that every small travel agent everywhere in the country faces direct e-commerce type competition.

We are already in the 'Information Age', despite the consolidations and share implosions. Periods of major restructuring and realignments at the international as well as national level are to be expected in any fast-moving sector that is characterised by rapid technological innovation. Nevertheless, even after significant consolidation, information and communication sector companies are and can be expected to remain key powerhouses of growth and development for the future.

3.   Trends in Applications and Services

 We have all heard of "Moore's Law", that says computer power doubles every eighteen months. However, globally, network bandwidth has been growing at a rate three times faster

than computer power. Such an increase in bandwidth leads in the short term to the inevitable price reductions that we have seen, but it also has the effect of drawing more devices such as PC's to link to the network. As the number of devices increases, the value of a network itself increases roughly proportional to the square of the number of devices attached to it. Moreover, as was pointed out at one of our ODTR events[2], the Internet has developed to the extent that it can now be regarded as a 'general purpose technology'[3] permeating a wide range of economic and social activities. Electronic mail, web browsing and early-stage e-business are already commonplace. When the ODTR started in 1997 and we decided to have a web-site, this was seen as rather unusual. Now a majority of advertisements in Ireland carry a www address.

Looking forward, these early applications are likely to be joined by others such as new and sophisticated on-line learning and medical services and *telepresence*, or *virtual reality* – whereby sophisticated computing and communications techniques typically convey three-dimensional images and other sensory information, for example for simulation training or virtual meetings.   There have been many false dawns and expectations of ever more rapid adoption of technologies. However anyone reviewing the position over, say, five years can see a major difference. This is so even among the generations who grew up in a world where you did your work on paper, where you did your sums with a slide rule, and where there was 'the phone' in the hall, to be used sparingly and with permission for local calls only. In the developed world we shall soon enter an era in which almost all schoolchildren and students, and large numbers of those entering the workforce will not have known life before the Internet. People who do not already use Internet-based services at home and at work, will

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[2] See ODTR Document 00/80 – "New issues in the Telecommunications Sector 2002- 2010" – presentation by A. Tumolillo, Probe Research Inc.

[3] Alongside electric power, combustion engines and semiconductors, for example.

come to expect them as the norm, wherever they are. A key point to bear in mind here is that sustainable growth will come about more from the emergence of interesting new applications which people want to use rather than from "technology push".

The popular services of today, such as telephony, mobile text messaging, e-mail, peering and web browsing, are still for the most part capable of being delivered over communication networks that were designed for voice telephony and low-speed data communications. Broadly speaking, such networks, except for the most recently installed international links and a few national backbones, are probably going to be able to support only the types of services that are in common use today. However, the new applications that are already being used or developed in universities and other R&D environments typically require communications infrastructure that is capable of handling data rates that are many times greater. For example, in the US, the National Science Foundation recently announced the building of a massive computing grid called the Distributed Terascale Facility, due to be completed around this time next year. This will connect four major US research centres conducting research in areas such as molecular modelling for detecting diseases, alternative energy sources, and climate and atmospheric simulations. The grid is being designed to process 13.6 trillion calculations per second and will have around 600 terabytes of data storage with network links capable of handling 40 gigabits per second. To put this in perspective, this computing grid will be more than a thousand times faster than the Deep Blue supercomputer that defeated chess champion Kasparov; its storage capacity will be equivalent to around 150 million full-length novels; and the network links would support more than three-quarters of a million 56 kbit per second modems. Its proponents claim that it will transform the way science and engineering research is done.

This example of very high data rate communications linking geographically dispersed researchers reinforces the point that the Information Age consists of much more than providing new ways of advertising and selling goods and services. It changes the whole business process for all kinds of manufacturing and services. The way in which some education services are offered and delivered is already being transformed, as a glance at the web sites of some learning establishments such as Stanford University will confirm. These new ways of delivering education will increasingly deploy sophisticated, interactive multimedia services, with bandwidth-hungry video featuring prominently. Given the strength of our education system, these new educational services present opportunities for our colleges and schools.

Another area in which we can expect to see further developments is machine-to-machine communications, including so-called intelligent appliances; already very important in the manufacturing sector. Business uses will be most important in Ireland given our population and the structure of our economy, but for example navigation, safety and crime prevention systems will develop rapidly from the small beginnings we see today.   The concept of 'domestic appliance' will also change, with an ever-extending range of intelligent devices to supplement the current functionality of the 'white goods' of the kitchen as well as transforming the PC, TV and hi-fi. As with the 50 programme washing machines of the 1980s, it may take manufacturers a little time to identify the much smaller number of really useful functions, but this will come. This will lead to the relatively new concept of home area networks becoming commonplace, and to new developments and growth in the more familiar local area networks. Short range radio devices and technologies such as wireless LANs – capable now of 11 megabits per second data rates, and 50 or even 100 megabits per second sometime next year - are already beginning to feature prominently in locations such as

hotels and airports. While much machine-to-machine communication will be over short distances of a few metres, we can nevertheless expect to see significant growth in long distance communications traffic, especially when appliances connected to the Internet becomes the norm.

With these new applications and major shifts clearly on our radar screen, there is still a clear global growth trend for information and communication services over the medium and long term, notwithstanding the many downbeat forecasts we hear, many of which focus on the short term. However, before many of the economic and social benefits of the new applications can be realised in Ireland, there needs to be very considerable increases in available bandwidth, especially at national level. Therefore, one of the key challenges Ireland faces is to ensure there is sufficient broadband access to sufficiently high capacity backbone networks and international connections.

4. **Current and future infrastructure needs**

A prominent feature of modern communications is the need for global connectivity. Many of you will be aware of the significant investments that have been made recently in new international cables linking Ireland to the global telecommunications networks, and despite difficulties in international markets, there is still interest in developing further connections. Just as it is vital for Ireland to have good international communication links, it is equally important for us to have good national and local trunk networks, to carry communications traffic around the country, and to the gateways to our international links. Again we have already seen recent investment in new fibre optic cables for the national trunk networks

capable of handling much greater traffic volumes – typically hundreds or thousands of times more - than the old copper cables and microwave links that they are replacing.

In Dublin, and in other cities where there is heavy communications traffic, we require so-called metropolitan area networks that have many of the same characteristics as the national trunk network. Around Dublin we have seen the installation of significant amounts of new fibre optic cabling, largely to meet the needs of business users in the first instance. Large enterprise networks generally tend to be very advanced, requiring very fast access, direct connections to the Internet, virtual private network capabilities and the latest and fastest routing and transmission infrastructure. Enterprise networks have a heavy influence on the overall development of communication networks.

Internet Data Centres are examples of relatively new bandwidth-intensive enterprise activities that have arisen out of Internet expansion. They require continuous and un-interruptable broadband connectivity of much higher quality standards than were required in traditional networks that handled mainly voice traffic. My Office is placing strong emphasis on network resilience, not only in terms of fixed infrastructure, but also in mobile networks, which currently fall a long way short of what we consider acceptable.

Given the recent investments in international and trunk communications infrastructure, how are we doing in terms of meeting requirements? Overall, we are seeing significant improvement compared to the pre-liberalisation era. As I have mentioned, fibre optic cables have become the norm for key major routes. Communications infrastructure build is fully liberalised and it does not require a licence from the ODTR, although there are serious issues in respect of planning to which I will return. A telecoms licence is required only if you

intend to offer telecommunication services to the public, or need to use the radio spectrum. While a few companies have taken advantage of this liberalised environment, it would be our view that there is still scope for more to do so.

As I indicated at the beginning, it is not just a question of creating competition in respect of traditional applications such as telephony, but seeking to ensure that the network is adequate to carry the needs of new business developments, and all the new applications coming on stream and the increasing demand for them.   Generally speaking, despite recent improvements, trunk infrastructure outside Dublin is still insufficient. This acts as a significant deterrent to investment in certain parts of the country. At a time when new investment projects are being heavily scrutinised, the relationship between trunk infrastructure roll-out and regional development is becoming a *Catch 22* situation that must be broken. . This will require vision and leadership, largely from the private sector and policy makers responsible for encouraging economic and regional development. While the general enabling regulatory framework is already in place, my Office will play its part by continuing to adapt and refine it to deal with bottlenecks and other problems of implementation, and remaining on the lookout for and addressing new regulatory issues arising from market and technological developments.

Let me expand on the regional situation. It is natural in a liberalised market for new entrant public network providers to focus on high-density population areas, and some of them have done this in building alternative networks around Dublin. Operators have faced substantial constraints in terms of planning permissions in many parts of the country, both urban and rural. In terms of regional development generally, telecommunications infrastructure faces similar problems to all regional infrastructure development - there is a generalised demand

for ubiquitous competing infrastructure, but as a nation we find it very difficult to set out a reasonable plan to achieve this. Like all other plans, such development has to take place in stages, and in the absence of agreement on the stages, nothing much may happen at all, particularly in the current investment climate.

The debate on the national spatial strategy is underway. It is a very important debate with difficult trade-offs between numbers and size of priority centres for development on the one hand, and the economic costs in terms of infrastructure build for utilities, whether roads, telecoms or electricity, on the other. There are issues of minimum critical mass that need to be calculated carefully so that we do have a real spatial strategy, not just a pipe-dream.

It is not for the ODTR to determine what centres are prioritised. It is our job however to seek to ensure there are many alternative ways for operators to use and build infrastructure. These alternatives include unbundled loops, wireless local loop and satellite technologies, as well as new cables.   These options will enable new entrants to make a significant contribution, aided by other emerging and developing technologies.

5.   Planning issues

The next critical issue is planning. We simply must sort out the planning disarray at local level – and quickly. Public and private network operators are coming to me with stories about their difficulties in trying to obtain planning and wayleave consents. There is a wide variation in performance even in adjoining areas and in many cases, they report inconsistencies, lack of transparency and bureaucratic delays that have no place in modern administration.

As a nation we are well capable of solving these problems, and it is as easy to have a fair, transparent and fast system as a slow and unclear one. For example, I would like to see on every county council's web site clear statements of planning policy and rules as applied to telecommunications infrastructure, above and below ground. I would also like to see clear, helpful guidelines and swift procedures, including names and contact details, set out for potential applicants who are considering laying or repairing cables, or installing radio masts or dishes, or equipment for local loop unbundling (LLU).   Sub-loop unbundling could be very useful in Ireland to supplement LLU at switches, but operators are hesitating as it means developing street installations. Should this be the case?

Is it not reasonable to expect the planning departments of the councils to harmonise their policies and procedures so network providers are able to move quickly to bring the most up-to-date and advanced services to business and residential consumers? Could *all* local authorities and the National Roads Authority make provision for ducting as part of any new road, water, sewage or other infrastructure development?   Is it reasonable for Ireland's consumers – parents, students, doctors, and job creators - to be denied ready access to new education, medical and business services because network providers cannot find their way through the planning jungle? I think not.

Before I move on from local issues, I would just like to take this opportunity to comment on the topic of masts and aerials. Where consent for these is required, it has to be obtained from local planners, not from my Office. If consumers demand mobile services, as they clearly do, then masts, aerials or dishes cannot be avoided. It may be the case that some areas will wish

to opt out completely from such developments, but if they do so, they are making a choice against commercial development of their area, and this needs to be fully understood.

6. How much bandwidth?

There is scope for more companies to consider building new trunk infrastructure to improve what we have now, but also in readiness for the bandwidth hungry new information and communication applications I mentioned earlier. What scale of new communications infrastructure capacity will be required and when? Are we talking about a fifty per cent increase, doubling what we have, or orders of magnitude increases? Do we need them now, in three years time, or not for ten years? Opinion varies. Some analysts argue that we have a bandwidth glut. Others disagree. Who is right?

Throughout the history of telecommunications commentators have been debating this point. Experience has shown that whereas from time to time there may have been examples of too much capacity, it has generally been localised or short-lived. By way of illustration, one of my colleagues tells the story of how in 1991 he witnessed a group of senior executives in one of the global telecommunications companies scoffing at one of their colleagues advocating investing in international cables capable of providing gigabit per second services. Yet today much larger cables – many thousands of times larger - are in use both in and between large cities around the globe.

 Fortunately, engineers and scientists are succeeding in lowering bit-rate costs almost as quickly as they are succeeding in increasing the information carrying capacity of fibre and radio links. If we can get the physical installation sorted out, the infrastructure challenges

and investment requirements, significant though they are, may not be as daunting as they might appear at first sight.

7. Press on or wait and see?

While the telecoms sector is going through a period of correction and realignment we are experiencing a slowdown in the building of new infrastructure. This is to be expected while budgets and investment proposals are being heavily scrutinised. It is important that we seek to press ahead on all fronts – fixed, mobile, satellite and other new technologies - and iron out any difficulties to ensure that we keep up some momentum and continue to bridge the gap in terms of bandwidth needed for the future.

The telecoms sector is of course a global one, and other countries are contending with many of the same issues that we face here. What approaches to communications infrastructure are being adopted elsewhere? Some countries seem to be doing little; presumably hoping that market conditions will improve naturally. This may be fine for countries whose economies are not perceived as being closely tied to the high technology and communications sectors. How many of them would be right in taking this view is debatable. For a country with Ireland's economic characteristics however, such a "wait and see" approach would be leaving far too much to chance. Several other countries including Canada, Sweden, the Netherlands, South Korea and New Zealand have also declared strong commitment to developing their national telecommunications infrastructure to meet the needs of the next generation of information and communication applications.

So do we press on or wait and see? I think the message is clear. Ireland's vision of being an influential player in the Information Age is correct. We must press on if we are to achieve it, and improving our communications infrastructure is a vital part of doing this.

8. Broadband local access

Some countries such as Japan are working towards universal access of fibre to the kerb. Should this be the target for Ireland?   This has to be considered in the context of the other crucial communications infrastructure: the local loop, often referred to as the first or last mile. The benefits of major networks will only be realised if users can readily access these "information highways" using high bandwidth connections at reasonable prices. There is a range of possibilities such as local loop unbundling and fixed wireless access already provided for, which have their strengths and limitations, and there are others coming on stream.

These technologies are relatively new in handling the major applications we now envisage for them. I believe that there is much to be done in developing them further to make them easier and cheaper to install and operate. Some of you may wish to take up this challenge. I also believe Ireland is well placed to do some of this research and to benefit from the developments. For existing markets the introduction of carrier pre selection cuts down the costs and ease of shifting from one operator to another, a key factor in opening up the existing telephony market.

There are various technological options for providing local access infrastructure. Some of these were described in a paper we issued recently describing some new developments in

telecommunications[4]. They include fibre optic cables, coaxial cables, DSL[5] over copper wire, fixed wireless access, and satellite systems. For the most part, these have already received much attention from the industry and the ODTR, and rather than discuss all of them here I would refer you to our web site.

However I do want to spend a few moments on one of the topics, namely optical wireless. While it is generally regarded as a new technology, it has in fact been around for more than ten years. It originated, as so often is the case, in military communications. At present, it is used to a limited extent in private networks, and we suspect there may be significant replication opportunities for it in Ireland. Perhaps even more significantly, and hence the reason for my singling it out here, is that it is being suggested in some quarters that optical wireless could also be capable of helping tackle the problem of last mile broadband access in public networks. It would appear to have the potential for operators to install reasonably reliable gigabit per second links of a few kilometres very quickly and inexpensively using equipment that is no more obtrusive than typical security cameras.

Whether or not it can do this remains to be seen. In publishing our new developments paper, we have particularly asked for views on the possible roles that optical wireless systems, and other technological developments outlined in the paper, might play in helping bring broadband access and services to consumers. If in the responses key points or significant lessons are raised, we will consider publishing these in a follow-up paper.

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[4] See document 01/59 on www.odtr.ie
[5] DSL stands for digital subscriber line. There are several variants including ADSL (asynchronous), HDSL (high-speed) and VDSL (very high-speed).

It is neither for the ODTR to pick technological winners, nor to recommend to operators or consumers how to build networks, or how to access communication services. However part of our role is to be pro-active in seeking to have telecommunication companies deliver a good range of high-quality communication services at attractive prices. This extends to informing telecommunications operators and consumers about new and developing technologies as well as setting up any regulatory rules for using them.

9. Private networks

We are aware of a number of instances in which private network operators opted to install and operate their own links rather than lease capacity from a public network operator. For example, at the University College Cork, they have been operating several wireless optical systems for some years to link campus buildings that are located in various parts of the city. For their particular needs, they have found this to be highly advantageous in terms of cost and delivery times compared to what was on offer from public network operators. Such a solution will not suit all private network operators, but it does serve as a reminder that there is an alternative in some instances to obtaining last mile connectivity and access from public network operators. Indeed, several of the developing technologies such as IEEE 802.11/Hiperlan technologies offer the opportunity to build new and relatively inexpensive types of private networks. The ODTR recently published a paper indicating spectrum availability for such technologies.[6]

10. Conclusion

There are many parties involved in meeting the challenges of information and communication technology. Government and Government bodies provide support for development, for research into making the technology cheaper and more readily available, and for guiding the identification of the priority areas for development. At the ODTR we have a responsibility for removing barriers to competition wherever we can, and for providing a regulatory environment that facilitates as many ways of delivering infrastructure and services as possible.

I am looking to the IEI, the engineering profession and the universities to ensure that we have sufficient high calibre engineers trained in key disciplines such as optoelectronics, software and network design. IEI members who have a particular understanding of the issues and of the skills needed for dealing with them are in key positions in business and in Government services. Planners have a major role to ensure we have a simple and transparent local planning environment that facilitates investment in communications infrastructure. And I am looking to the industry – established players and new entrants alike - to take big, bold steps in bringing state-of-the-art networks and services to consumers, so that Ireland plays a leading role in the Information Age.

In the sector I regulate, there is no place for hesitation or conservatism.

Thank you.

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[6] See www.odtr.ie, document 01/70